Virtual Interview Training Increases Job Offers for Veterans and Others

Dale E. Olsen, PhD;
Laura B. Humm, BS

SIMmersion
Columbia, Maryland
Dale.Olsen@SIMmersion.com
Laura.Humm@SIMmersion.com

Matthew J. Smith, PhD, LCSW,MPE;
Michael Fleming, MD, MPH
Neil Jorden, PhD
Northwestern University Feinberg School of Medicine
Chicago, Illinois
MatthewSmith@Northwestern.edu,
M-fleming@Northwestern.edu
Neil-jordan@Northwestern.edu

Morris D. Bell, Ph.D., ABPP
Yale School of Medicine, Dept. of Psychiatry
morris.bell@yale.edu

ABSTRACT

It is difficult for Veterans with Post Traumatic Stress Disorder (PTSD) and others with disabilities to enter the workforce, resulting in a low employment rate. The job interview presents a critical barrier for obtaining employment. To improve job interview skills and the employment prospects of people with disabilities, we developed Molly, a virtual human resource manager. The simulation provides repeated job interview practice with extensive feedback and accommodates a variety of special needs. This paper will focus on the methodology and steps used to develop the simulation, and then report on four single-blind controlled studies and four field validations of the training solution.

During each virtual interview, Molly asks trainees questions about their skills and experiences. Using information provided on a job application, she randomly selects questions tailored to the trainee's needs from a database of 1,200 options. The trainees practice until they master the skills at three difficulty levels.

The four studies included veterans with PTSD (n=33), people with mood disorders (n=37), people on the autism spectrum (n=26), and people with Schizophrenia (n=32). Those who used the simulation (treatment) demonstrated significantly greater improvement than the control group during live role-play interviews showing efficacy. They were also more confident in their interview abilities. Separate follow-up studies surveyed people from these study groups after six months. For each follow-up study, people from the PTSD and the Mood Disorder Cohorts were combined. The data analysis used logistic regression to adjust for known covariates and to estimate the odds of receiving a job offer. For each study group the estimated odds of receiving a job offer were about 8-9 times greater for the treatment group than the control group.

ABOUT THE AUTHORS

Dr. Dale Olsen launched SIMmersion LLC in October of 2002 after 29 years of service at the Johns Hopkins University Applied Physics Laboratory (JHU/APL). He joined JHU/APL and helped develop techniques for evaluating both the reliability and accuracy of submarine launched ballistic missiles. In 1989, he developed a patented algorithm for the automatic detection of epileptic seizures using EEG data. This research lead to the development of algorithms for evaluating polygraph data and to a software system that called for the analysis of that data, producing results more accurate than human evaluators. In 1997, Dr. Olsen recognized a critical need for human simulations and created a training simulation for teaching interview techniques to the FBI and other law enforcement agencies. The technology evolved into the PeopleSim® conversation engine used today. Dr. Olsen has numerous publications and fifty years of experience as both a researcher and a manager. Dr. Olsen holds a Ph.D. in Statistics from Oregon State University.

Laura B. Humm is the Chief Operating Officer at SIMmersion. Ms. Humm began working at SIMmersion when Dr. Olsen founded the company in 2002. Her dual degrees in psychology and sociology combined with her interest in computer-based training helped her create her first simulation to train cross-cultural communication skills to FBI agents. Under her direction, SIMmersion has successfully developed programs for the National Institutes of Health, Centers for Disease Control and Prevention, U.S. Army, U.S. Air Force, U.S. Navy, U.S. Marine Corps, the Federal Bureau of Investigation, the Department of Defense, and the Intelligence Community on a variety of topics, including social skills training, cultural sensitivity, suicide intervention, alcohol and drug screening and brief intervention, motivational interviewing, vocational rehabilitation, psychological health education, customer service, anger management, diagnostic medicine, domestic violence, sales and recruiting, investigative interviewing, and courtroom testimony.

Matthew Smith, PhD. is an Assistance Professor at Northwestern University Feinberg School of Medicine, Department of Psychiatry and Behavioral Science. He has a wide breadth of training in social work, psychiatric epidemiology, behavioral interventions, and translational neuroscience. In 2008 he transitioned a postdoctoral fellowship from Washington University in St. Louis to Northwestern University. At that time, he began work on an NIH Grant titled "Neuromorphometry of Schizophrenia by Computer Algorithm". He designed the infrastructure of a clinical research lab at Northwestern to support the collection of data for the study. He also designed a Chicago-based network of mental health service providers to recruit clinical research participants that includes more than a dozen service providers and more than 400 adults with schizophrenia. He co-directed a series of randomized controlled efficacy trials testing the efficacy and acceptability of virtual reality job interview training (VR) among adults with mood disorders, young adults with high functioning autism spectrum disorders, adults with schizophrenia, and military veterans with post-traumatic stress disorder. Moreover, he developed a large network within the autism community across the State of Illinois. This network was facilitated through his relationship with Illinois' Division of Rehabilitation Services. Dr. Smith has a PhD in Social Welfare from Washington University and Postdoctoral Fellowships from both Washington University and Northwestern University.

Michael Fleming, MD, MPH is a senior physician scientist and professor at Northwestern University Feinberg School of Medicine, Department of Psychiatry and Behavioral Science. He is one the world's leading experts in the development and testing training simulations for a variety of professional groups and vulnerable populations. His work has been funded by the National Institutes of Health for over 25 years. He was elected to the US National Academy of Sciences Institute of Medicine in 2005 for his research and education programs. Recently, the National Institute of Health has supported Dr. Fleming

with training grants on alcohol screening and brief intervention, screening and follow up for prescription drug abuse, vocational rehabilitation for special populations, and to reduce student drinking. He has extensive experience training and utilizing standardized patients for his research.

Morris Bell, Ph.D. ABPP is a Professor in the Department of Psychiatry at Yale University School of Medicine and Senior Research Career Scientist for the Rehabilitation Research and Development Service of the Department of Veterans Affairs, USA. He directs the Yale/VA Learning Based Recovery Center. Dr. Bell has been a researcher for 40 years exploring ways to restore cognitive and work capacity for people with severe and persistent mental illness and is considered a pioneer in the field. He was among the first to study the beneficial effects of work activity and to explore determinants of work capacity in schizophrenia. Dr. Bell has developed a number of learning-based interventions to promote recovery in schizophrenia and related disorders. He has conducted a number of studies that combine new methods of cognitive retraining with employment services to improve functional outcomes. Current studies involve cognitive training for treatment of substance use disorders and mild TBI. He was also the principal proponent for the development and testing of SIMmersion's virtual reality software *Job Interview Training with Molly Porter*. Dr. Bell is the director of a fellowship program awarded to him by the National Institute of Mental Health to train psychiatrists and psychologists in doing research related to functional disability in mental illness.

Neil Jordan, PhD, is an Associate Professor of Psychiatry, Healthcare Studies, and Preventive Medicine at the Northwestern University Feinberg School of Medicine. Trained as a health economist and health services researcher, he has been a faculty member at Northwestern since 2004. Dr. Jordan's research focuses on identifying high value services and systems of care for persons with complex chronic illness. At Northwestern, Dr. Jordan directs the Mental Health Services & Policy Program and the Health Economics Program. Dr. Jordan is also a Research Health Scientist at the Center of Innovation for Complex Chronic Healthcare at the Hines VA.

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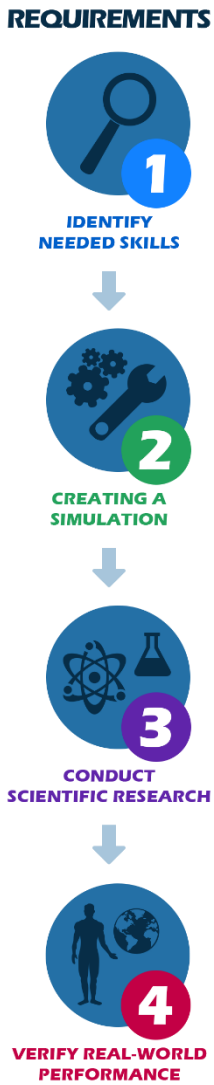
OVERVIEW

Goals of Training Simulations

What are we really trying to accomplish when we create a training simulation? The ultimate goal is to improve "real-world" performance sufficiently well to meet specific training objectives. Ideally, we should be able design and construct the simulation to develop specifically identified skills. Once the simulation is developed, validation studies should show the skill-building goals have been achieved. Next, it must be shown that the identified skills do meet the "real-world" objective. The entire process involves four steps, labeled here as requirements. The requirements are:

Requirement 1: Identify the skill needed to meet the objectives
Requirement 2: Create a simulation capable of developing the identified skills
Requirement 3: Train people using the simulation and show that they have reached the required level of skills in a scientific research study
Requirement 4: Show that these skills have the desired effect on "real-world" performance



Often it is not possible to meet the four requirements, particularly the last one showing that the goal of having an important "real-world" effect has been achieved. However, with support from the National Institute of Mental Health, Dr. Morris Bell from Yale University and a team from Northwestern University Feinberg School of Medicine, our team was able to develop a simulation that meets all four requirements. Our desired objective was to use a simulator to train people with severe psychiatric disorders (e.g., veterans with posttraumatic stress disorder (PTSD), those on the autism spectrum, schizophrenia, or mood disorders) to perform well enough in a job interview that their opportunities for employment would be substantially improved; for example, doubling their chances of receiving a job offer.

Background

Not surprisingly, unemployment is common among individuals with severe psychiatric disorders. Returning to work helps reintegrate individuals with disabilities into their community, an important element for recovery and a key objective of the Americans with Disabilities Act (ADA). Surveys indicate that more than 75% of people with these disorders wish to return to some kind of productive activity (Becker, 2002). However, when they attempt to return to work, they often have difficulties gaining employment. They become discouraged when they fail to find or maintain a job. As research has shown (Becker, 2002), unemployment itself can lead to deterioration in mental and physical health in previously healthy individuals, and these consequences are all the more serious for those with severe mental disorders. The US Department of Veterans Affairs (VA) is the largest single provider of mental health services in the United States. Currently, there are more than 800,000 veterans with psychiatric and substance

abuse disorders served by the VA, but fewer than 30,000 are receiving rehabilitation services, suggesting a significant shortfall. Specifically, symptoms of PTSD experienced by veterans of the United States Military limits their reintegration into competitive employment (Magruder et al., 2004; Smith, Schnurr, & Rosenheck, 2005). Moreover, available evidence suggests that veterans with PTSD are 19 percent less likely than veterans without PTSD to be employed even after completing the Veterans Health Administration vocational training programs (Resnick & Rosenheck, 2008). The goal of our work was to develop a simulation that would substantially increase the job opportunities for veterans and others with similar disabilities. To accomplish this goal, we needed to demonstrate that we could meet the four requirements described above.

REQUIREMENT 1 - IDENTIFYING REQUIRED SKILLS

To identify the required skills, we consulted leading experts in the field, including Drs. Morris Bell, Matthew Smith, and Mike Fleming, co-authors of this paper. In addition, we consulted experienced human resource hiring personnel and the Maryland State Prison vocational training program. Research revealed the following job interview skills were most important to employers when hiring for entry level positions:

- **Being honest:** Employers want to hire people they can trust. Learners need to be able to answer all questions honestly. Learners will be asked about stealing or lying and will need to know how to respond truthfully.
- **Being Dependable:** Employers want to hire people who will work hard and be on time. Learners need to respond in a way that portrays they are hard workers. They should give examples of times when others were able to count on them.
- **Displaying Teamwork:** Employers want to hire people who work well with others. Learners need to respond to questions in ways that portray them as pleasant people. They should give examples of times when they worked well with bosses, co-workers, or friends. Being flexible is another way to show that they are easy to work with.
- **Being Positive:** Employers want to hire someone who can do a good job. Learners need to use every question as an opportunity to say something good about themselves. There may be times when they have to say something negative, but should be sure to follow it up with something good. This will show employers that learners have positive attitudes.
- **Being Able to Negotiate:** It is important for learners to find a job that will meet their needs. It may be necessary for learners to ask for a certain day off or to ask about salary. It is important to learn when the time is right for any negotiations.
- **Showing Interest:** Employers want to hire someone who cares about the job and the company. This is because people who care about their jobs tend to work harder. Showing interest in the job and the company will help the employer see that candidates want the job. Asking questions is a good way to show interest.
- **Being Professional:** Being professional means being polite and respectful. Learners should avoid moving away from job-related topics.

Based on our research and the available evidence, we believed that people with the identified skills would get more job offers than those without. The questions remaining include:

- Can a simulation train these skills?
- If so, will increases in these skills translate into more job offers?

To answer these questions, we built a simulation (requirement 2), used it to train people who in turn could be assessed for increases in skill level (requirement 3), and followed up to investigate improved "real-world" outcomes, e.g. doubling the odds of receiving a job offer in six months (requirement 4).

REQUIREMENT 2 - APPLYING THE PEOPLESIM® SIMULATION TECHNOLOGY

To meet Requirement 2, we needed to use both the right simulation technology and to provide the right content to develop the skills identified in Requirement 1. The technology will be described first.

Basic Technology and Its Application

SIMmersion's PeopleSim conversation engine drives simulations that combine video, voice recognition, and flexible user control to create an interactive environment. In order to make the simulation as life-like as possible, we record video of an actor in the role of the simulated character. The video is separated into hundreds, and sometimes thousands, of response clips that are played at appropriate times during the simulated conversation. For the Job Interview Training system, learners conduct face-to-face conversations with a simulated human resources manager named Molly Porter. The combination of features allows learners to participate in the interactive, immersive environment, reacting to questions and complex social cues provided by Molly.

The PeopleSim technology is designed for all types of conversations, including cases where (1) the learner leads the conversation, such as a doctor interviewing a patient, (2) the user and simulated character take turns leading, such as in negotiations or sales, or (3) the simulated character leads the conversation, such as a simulated prosecutor examining a witness in a courtroom. For this application, Molly, the simulated person, controls the interview by asking questions the learner responds to, often selecting from ten or more answers to her question. This long list of learner options, coupled with immediate feedback, is designed to support the learner in gaining an understanding of what is appropriate, what is not, and why.

The Job Interview Training

To encourage continual practice of job interview skills with the simulation, and to provide 'easy,' 'medium,' and 'hard' levels of play, we created four versions of Molly. She can be (1) friendly and supportive, (2) business personal, focusing on how the user could excel, (3) business serious, focused on the job and what benefits the company, or (4) inappropriate, asking illegal questions. The software selects one version, at random, at the beginning of each conversation, but limits the versions of Molly available based on the level-of-difficulty the user selected for the play. Within each version, Molly has memory, and her behavior is affected by an advanced model of emotions, driven by the learner's answers to her questions. If the learner creates a negative relationship, then Molly will become less supportive and the score will indicate that the employer will not offer a job. Conversely, if the learner builds a positive relationship and provides appropriate answers, Molly becomes warmer and the scoring will indicate the interviewer earned a job offer.

Molly can ask any of her 1,200 questions or make other statements at any moment; learners have more than 2,000 possible ways to respond. Molly must also decide what questions to ask or how to respond to the learner's questions or statements. For each of her questions or statements, there is an associated list of possible learner responses; optionally, the learner can choose to not respond directly and can change topics. Molly will also give the learner a chance to ask questions, turning over control of the conversation. As with a real employment manager, the way Molly selects her statement is affected by three factors:

1. The history, including the job application, identified preferences, and previous responses.
2. The version of the character (friendly to inappropriate), as randomly selected at the start of the session.
3. Her personal feelings or emotional state, driven by learner's statements.

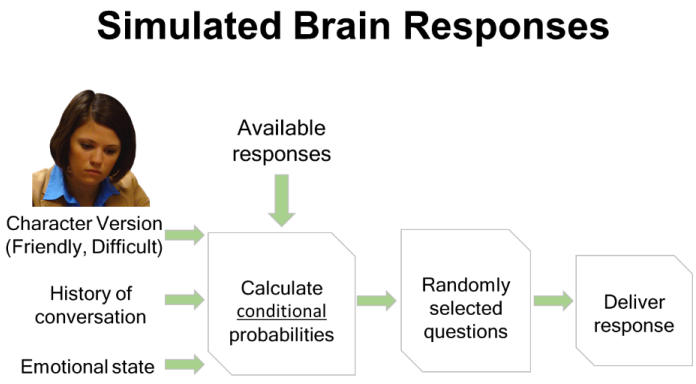


Figure 1 Molly's Question Selection

Each of these factors affects the computation of conditional probabilities associated with possible questions or statements Molly may speak. Because of the variable nature of the user's choices, the path to any point in the conversation is unpredictable. As a result, the conditional probabilities must be computed "on-the-fly." Then, those probabilities are used to randomly select Molly's choice of a question or statement.

To maintain conversational consistency, the logical ties between a learner's statements and Molly's responses constantly change. Any of the learner's responses or even Molly's selected statements can dramatically affect the

connections between and availability of any of the other statements or questions. If the learner says that he or she can't work more than 25 hours a week, that statement impacts the remaining conversation; many potential user statement-response connections would be severed and new ones would be created. For example, the interviewer would no longer be able to ask, "Are you available to work full-time?" but would be able to state, "We have several part-time opportunities available." The complexity of the interrelationship logic is customized for each PeopleSim simulation. The development of the required dynamic logic makes the construction of SIMmersion simulations labor-intensive, but produces unmatched training results. All questions, responses, and statements are scripted utilizing the field experience of experts to recreate what real people say. User options consist of a blend of typical new learner statements and desirable candidate statements, allowing the learner to behave in a typical manner and then begin to rescript their statements as they learn the correct things to say. This range of possible statements produces realistic, unpredictable simulated characters and conversations that are never the same twice. Research has shown that non-branching logic incentivizes many hours of practice (Fleming et. al., 2009; Olsen et. al., 1999; Olsen, 1997).

Feedback

To help learners achieve their goals, they receive feedback from an on-screen coach who provides nonverbal cues regarding user questions and statements. For example, if the learner selects a poor statement, the coach may give a "thumbs down" sign. If the learner is unclear about any feedback, he or she can view a more detailed written explanation about why the specific statement was a poor choice (e.g., "Your choice does not highlight your skills and abilities.").

Figure 2 Coach Gestures

When using the Job Interview Training system, learners with disabilities can decide whether or not to disclose their disorders and/or disabilities during the interview. The rich script allows them to do and say what they want, when they want. As a result, learners can disclose this information early in one interview, at the end of another interview, and not at all in the next. The speech recognition feature enables users to rehearse responses and improve their job interview comfort level. Adults with psychiatric disorders often have difficulties preparing positive answers to difficult questions during an employment interview. The use of speech recognition technology allows learners to practice speaking pre-scripted positive responses to these difficult questions in a pressure-free environment. Then, in a real interview, they can utilize the rehearsed answers, approaches, or ideas practiced within the simulation. If the speech recognition feature is not used, learners use a mouse to select what to say next and hear that response choice spoken in a male or female voice, depending on the learner's gender.

Individualized Customization

The goal of the training is to create the most realistic replication of a job interview possible. We developed new software for part of the training to allow learners to fill out a job application as well as to provide some personal information which may or may not be obvious during a real interview. The training encourages the learner to practice completing a typical online job application, so Molly can question the learner as a real human resource manager would. The required employment application is similar to many used by larger companies and includes questions about employment history, skills, and contact information. Filling out practice applications prepares learners to accurately complete future applications. The information recorded in the application is then used by the simulation to populate Molly's list of interview questions. For example, a user may decide that he or she would like to apply for a customer service position on the application and identify that the previous job was for a construction company; Molly may ask, "I see from your resume that you have experience and are applying for a customer service position. Why are you looking to make that change?" Much like an actor rehearsing a part, the new individualized customization feature will allow learners to develop and practice appropriate interview skills. The simulation provides for hours of self-paced training in a safe and judgment-free environment.

As part of the customization, learners are able to select any of eight positions (i.e., cashier, store clerk, customer service, maintenance/grounds, janitor, food service, inventory, or security). Learners may disclose a range of information including spinal cord injuries, visible and hidden disabilities, a history of mental illnesses, military history, past substance abuse, and a criminal history.

The Content

Molly's questions, available responses, and feedback are the heart of the simulation content. She asks a series of pre-scripted questions, and learners are given many possible ways to respond. The learner options include several that are good and several that are not. Initially, the distinction may not be obvious to the learner. Learners build skill by selecting natural choices, including statements that they may have actually said in an interview, and then learning why their choice may or may not be a good one.

There are 1,200 video recorded questions and statements that can be selected for Molly to say. The questions used target certain populations and positions depending on the job application and also imitate different trends in interviewing. The questions were derived from several sources, including:

- A team of university subject matter experts
- Human resource managers from major department stores
- A bank of questions on the internet asked by employers during their actual interviews
- Questions Maryland State prisoners were taught to expect (bases for common illegal and harsh questions)
- Questions which help develop the required skills

The same team of subject matter experts helped to develop the response choices based upon the vast array of responses they observed as part of their work. These responses included common mistakes made by different populations as well as more general common mistakes. The exchange-by-exchange feedback and the after-interview scoring are based on the list of skills identified under Requirement 1.

REQUIREMENT 3 – VALIDATION RESEARCH STUDY OF EFFICACY

The third requirement calls for scientific validation of the simulation's efficacy at skill development. A prototype version of the training simulation had already been developed and studied with positive findings (Bell and Weinstein, 2011), suggesting the use of a randomized, single blinded control study would be an appropriate next step. With the support of Dr. Morris Bell and SIMmersion, Northwestern University conducted a randomized controlled trial to evaluate the efficacy of the training in a laboratory setting.

The Study Populations

Northwestern University conducted two rounds of research studies and two rounds of follow-up studies. For the first round, the University recruited 96 participants initially for three research studies with the goal of seeing if training with the simulation would develop the identified skills and change subject's behavior. Subjects were required to be at least 18 years old and unemployed or underemployed and actively seeking employment. They were also required to read at a sixth-grade level or higher and be willing to be video recorded. People with neurological conditions involving cognition (e.g. traumatic brain injury), uncorrected vision or hearing problems, or a current diagnosis of substance abuse or dependence were excluded. The subjects randomly selected to be trained are identified here as the Virtual Reality Job Interview trainees (VR-JIT); subjects selected for the control group were identified as the Treatment As Usual (TAU) subjects and were waitlisted for the training.

Three studies funded by the National Institutes of Health involved three distinct groups of people as shown in the table. The groups include veterans with post-traumatic stress, adults with serious mental illnesses, and adults with autism spectrum disorder.

Table 1 Three Initial Studies

	VR-JIT	TAU Waitlisted	Total	Qualifying Condition
Veterans with PTS	23	10	33	U.S. military veteran with a diagnosis of PTS
Adults with serious mental illnesses, primarily bipolar	25	12	37	Confirmed Diagnosis of major depressive disorder, bipolar disorder, schizophrenia or schizoaffective disorder
Adults with autism spectrum disorder	16	10	26	A T-score of 60 or higher or a clinical diagnosis
Total	64	32	96	

The fourth study followed the first three and was funded by the Department of Psychiatry and Behavioral Science at Northwestern University. This study focused on individuals with schizophrenia. See Table 2.

Table 2 Forth Study

	VR-JIT	TAU Waitlisted	Total	Qualifying Condition
Adults with Schizophrenia	21	11	32	Schizophrenia or schizoaffective disorder

Study Procedures

Baseline measures for all subjects included 1) demographic, clinical, and vocational interviews; 2) neurocognitive and social cognitive assessments; and 3) a pre-test self-report of self-confidence. After completing pre-test assessments, 2 out of 3 participants were randomly selected for the VR-JIT group. More details on the populations and the self-report on self-confidence are available. (Humm, et. al, (2014); Smith, et.al, (2014, a, b) Smith et al. (2015, a, b, c, d))

As part of the pre-test measurements, all subjects completed two 20 minute interview role-plays for a job in a department store. Participants were given directions stating, "You are interviewing for part-time work, particularly because you need to have Thursdays off for personal reasons. You will need to negotiate for a schedule that will accommodate for Thursdays off." Standardized actors posing as human resources representatives led the role-plays and were trained to ask 13 standardized questions and 3-4 random questions from a list of 70+ questions, in a naturalistic way. The job scenarios were developed by the research team and vetted through a panel of vocational rehabilitation experts. All role-plays were video-recorded for scoring purposes.

Role-plays were scored on nine communication skills identified as critical for successful interviewing. Role-play videos were randomly assigned to two raters with expertise in human resources and blinded to treatment group status. Both raters completed 10 practice videos to establish reliability before independently rating the study videos. The raters established reliability by double scoring approximately 20% of the videos and attained a high degree of reliability (ICC=0.84). To prevent rater drift, both raters met with the research team every 20 videos to review two videos and discuss inconsistencies and reach a consensus score. A total score was computed from nine evaluated criteria (range of 1-5 per criterion, with higher scores reflecting better performance) for each of the two baseline role-plays. The two total scores were averaged to generate a single score representing pre-test role-play performance. Post-test role-play scores were computed using the same method.

Following the completion of the initial job interviews, the TAU group attended their usual outpatient services for two weeks, which may or may not have included vocational training. The VR-JIT group completed up to 10 hours of VR-JIT simulations (approximately 20 interviews with Molly) across 5 visits within a two-week period, while also participating in their usual outpatient services. Both groups returned after two weeks to complete the post-test self-confidence measure (identical to the pre-test measure) and two post-test job interview role-plays. The VR-JIT group also completed a Treatment Experience Questionnaire (TEQ).

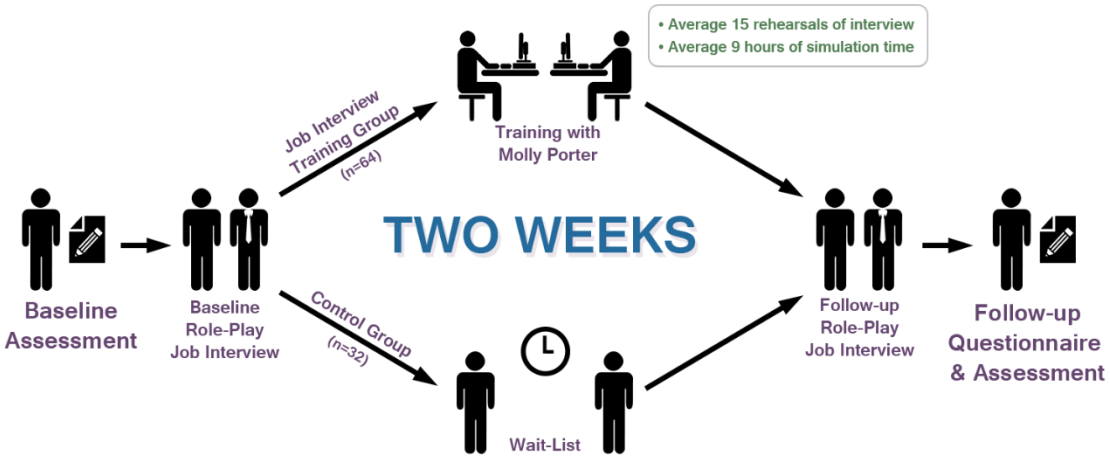


Figure 3 Experimental Design

Virtual Training

To promote hierarchical learning, trainees progressed through three difficulty levels. They were required to complete at least three 'easy' interviews. One score of 80 or higher was required on 'easy' to advance to the 'medium' level. Trainees automatically advanced to medium if they did not score at least 80 prior to completing 5 virtual interviews. This process was repeated for trainees at the 'medium' level before advancing to the 'hard' level. Remaining trials were completed on the 'hard' level. Staff reviewed the transcript with trainees for approximately 15 minutes after each completed virtual interview.

Data Analysis

Statistical analysis shows that the third requirement of having VR-JIT subjects reach a higher performance level was achieved and was statistically highly significant. Repeated Measure ANOVA analysis demonstrated a statistically significant difference between-groups which indicated that the training was efficacious. Table 3 shows the statistics for the role-play across each of the four studies. The references in the table provide extensive details.

Table 3 Mean (SD) Role-Play Scores at Pretest and Posttest Across Each Study

	Controls		Trainees		Group*Time F-Statistic, df	P-Value
Cohort	Pretest	Posttest	Pretest	Posttest		
Mood Disorder Smith et al 2014b	36.9 (3.4)	36.2 (4.0)	34.2 (5.3)	36.3 (4.0)	$F_{1,35}$=5.1	0.03
Autism Spectrum Smith et al 2014a	28.2 (5.0)	28.5 (6.1)	29.5 (5.7)	32.7 (5.7)	$F_{1,24}$=4.4	0.046
Veterans with PTSD Smith et al 2014b	34.8 (4.0)	34.9 (4.1)	34.0 (2.7)	35.8 (2.7)	$F_{1,31}$=3.4	0.04
Schizophrenia Smith et al 2015c	34.9 (3.6)	33.6 (3.3)	33.8 (5.9)	36.5 (4.4)	$F_{1,30}$=13.9	0.001

We also hoped that the training would improve the confidence of learners. In the self-report Treatment Experience Questionnaire, participants rated their self-confidence at performing job interviews using a 7-point Likert scale to answer nine questions, with higher scores reflecting more positive views (e.g., "How comfortable are you going on a job interview?").The results are provided in Table 4. The references in the table provide extensive details.

Table 4 Mean (SD) Interviewing Self-Confidence Scores at Pretest and Posttest Across Each Study

Table 2. Mean (SD) Interviewing Self-Confidence Scores at Pretest and Posttest Across Each Study						
	Controls		Trainees		Group*Time F-Statistic, df	P-Value
Cohort	Pretest	Posttest	Pretest	Posttest		
Mood Disordert Smith et al 2014b;	38.4 (13.2)	44.5 (8.2)	37.5 (12.5)	51.8 (8.9)	$F_{1,33}$=4.1	0.05
Autism Spectrum Smith et al 2014a	41.0 (9.6)	43.8 (9.1)	41.4 (10.6)	50.6 (8.4)	$F_{1,22}$=3.9	0.06
Veterans with PTSD Smith et al 2014b	49.7 (5.0)	51.0 (6.3)	44.9 (9.1)	51.2 (6.1)	$F_{1,31}$=2.0	0.09
Schizophrenia Smith et al 2015c	41.9 (14.0)	44.2 (11.5)	42.5 (13.7)	50.2 (8.8)	$F_{1,30}$=1.6	0.11

The figure 4 shows the effect size (also called Cohen's D statistic) for the first three studies and is used to present a visual view of the results. The effect size is the mean score divided by the estimated standard deviation of the sample. The critical requirement for this study was the score for the role play, shown in gold. The scores for the TAU group essentially stayed the same, where the VR-JIT group increased almost 50%. The figure also shows that the confidence increased for the TAU control group (effect size .36), but that the confidence increased significantly more (1.05) for the VR-JIT group.

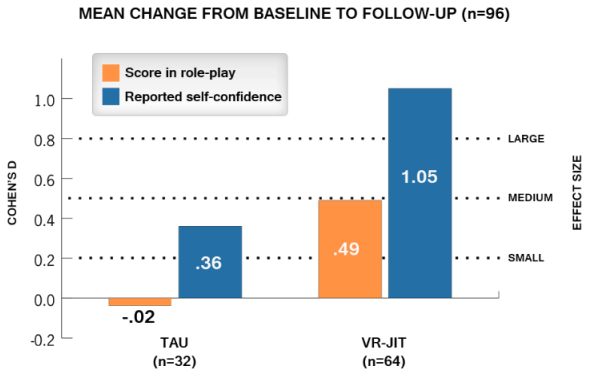


Figure 4 Effect Size for Role Play and Confidence

REQUIREMENT 4 – DESIRED EFFECT ON PERFORMANCE

While the scientific efficacy study showed that the training improved performance during realistic mock job interviews, it did not show that the training would have any "real-world" effect on the subject/candidate's actual ability to get job offers.

To satisfy the fourth requirement, Northwestern University independently surveyed all of the subjects who participated in any of the studies with a 6-month follow-up to assess the desired "real-world" effect. The results were surprisingly similar in each of the four different cohorts. The subjects were surveyed primarily to assess whether VR-JIT participation was associated with greater odds of receiving a job offer upon a 6-month follow-up. Not all subjects were available for follow up and some in the TAU waitlist group had utilized the training, so were no longer part of the TAU group. Follow-up subjects completed a brief phone survey approximately 6 months after participating in the randomized controlled trial. The descriptive statistic and basic results are presented in Table 5. The references in the table provide extensive details.

The Veteran-PTSD and Mood Disorder Cohorts

For this analysis, the research team combined the veterans-PTSD and mood-disorder groups. Fifty-one of the original seventy participants completed a phone-based follow-up survey at six months (n=39 VR-JIT trainees, n=12 TAU). The primary vocational outcome measure assessed was the number of job offers received. The proportion of

job offers attained was higher for the VR-JIT group than for TAU group. A logistic regression model was used to estimate the odds ratio of getting a job offer for the two groups. As shown in the first row of Table 6, those who were in the VR-JIT groups were **9.64 times** (p-value <0.05) more likely to get a job offer than those in the untrained TAU group after accounting for known covariates, e.g. cognitive function, recency of last job, and differences in diagnosis. For each additional practice interview with Molly, the odds of receiving a job offer increased by 1.41 ($p<0.05$). A greater number of completed VR-JIT trials predicted fewer weeks searching for employment (Regression slope $\beta=-0.74$, $p<0.05$).

Table 5 Descriptive 6-Month Follow-Up Data

	Mean (SD) Weeks looking for a job		P-Value	% Subjects Who Completed Job Interview		P-Value	% Subjects Who Received Job Offer		P-Value
Cohort	Controls	Trainees		Controls	Trainees		Controls	Trainees	
PTSD & Mood Disorder Smith et al 2015b	10.3 (9.2)	13.21 (9.9)	0.85	85.7%	82.6%	0.85	14.3%	47.8%	0.055
Autism Spectrum† Smith et al 2015d	16.3 (10.9)	13.5 (12.2)	0.60	62.5%	80.0%	0.33	25%	53.3%	.09
Schizophrenia Smith et al 2015c	17.3 (8.5)	11.3 (10.0)	0.11	83.0%	77.0%	0.64	25.0%	51.0%	.11

†data on the autism spectrum cohort reflects a job or volunteer position, and the % of subjects who accepted a job offer.

Table 6. Odds Ratio of VR Training as Predictor of Receiving a Job Offer

Cohorts	Odds Ratio	95% Confidence Interval	P-Value
PTSD & Mood Disorder Smith et al 2015b	9.64	1.48-62.92	0.02
Autism Spectrum† Smith et al 2015d	7.82	1.03-59.4	0.04
Schizophrenia Cohort Smith et al 2015c	8.73	1.17-65.00	0.04

†data on the autism spectrum cohort reflects accepting a job or volunteer position.

The Autism Cohort

Of the original 26 subjects with a diagnosis of Autism, 23 responded to the survey with 15 from the VR-JIT group and the remaining 8 from the TAU group. For this smaller cohort, the estimated odds ratio suggests that those who had the training were **7.82 times** (p-value = 0.04) more likely to get a job offer or a competitive volunteer position. This odds ratio used independent data, yet gave surprisingly similar results.

The Schizophrenia Cohort

Northwestern University conducted a separate study applying the same methodology to a population of adults with schizophrenia. This cohort utilized 32 subjects and found similar increases in skills and confidence for the VR-JIT group during the intervention period. Only two participants were unable to be reached at the six-month follow-up, leaving 23 from the VR-JIT group and 7 from the TAU group. For this group the odds ratio was **8.73** (p-value = 0.04) once again resulting in a similar estimate. As with the mood disorder/veterans cohort, the more the learners practiced, the more likely they were to get a job offer in six months (p-value = 0.03) and the fewer weeks it took. This estimated odds ratio also used data from a different study, yet gave surprisingly similar results.

COMMENTS AND CONCLUSION

Educational programs attempt to improve behavior by exposing people to information. However, educational programs alone are unlikely to develop a skill. For example, people can't become good leaders by watching a slide

show. Humans need practice and feedback to build skills. Simulations fulfill this essential need in a way that an educational program can't.

Training simulation developers do not often have access to the resources necessary for formal scientific validation of the effectiveness of their systems. In some cases, it is possible to conduct a formal research study to investigate the value of the simulation as described in requirement 3. However, these studies often only show the efficacy in a research environment. Even if the training is effective in a controlled environment, it is possible that the training has little influence on real-world behavior. Fortunately, this was not the case with Virtual Job Interview Training.

When all four requirements were met, this research shows a powerful, positive effect on real world results for the participants who used simulation technology to develop job seeking skills. For those of us who must live with knowing that few of our efforts will have access to sufficient resources to meet all four requirements, it is reassuring that, when the opportunity is presented to investigate actual effects, our work appears to improve real world outcomes so dramatically.

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